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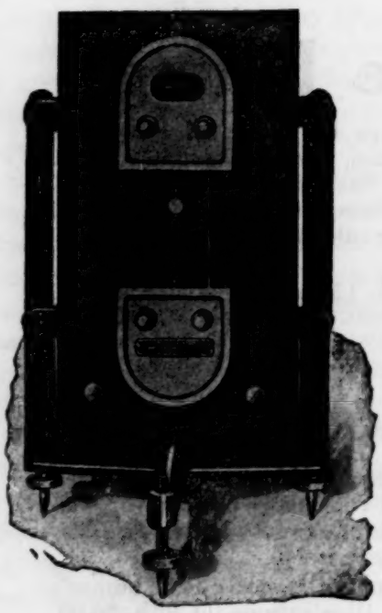

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THE DIVISION OF ANTHROPOLOGY AND PSYCHOLOGY OF THE NATIONAL RESEARCH COUNCIL[1]

A GENERAL of the regular army listening to a description of the National Research Council remarked, "You are the General Staff of the army of American men of science." The analogy is suggestive. Our war against the realm of the unknown calls for a determination of broad policies of strategy, as well as for skill in the tactics of attack. Ample resources must be planned for. The relative need for men trained in the various specialized duties of a complex organization must be ascertained. The most effective plans for employing both men and materials must be blocked out. Programs for meeting possible contingencies must be thoughtfully elaborated. New suggestions of method in organization must be pondered and tested. The Division of Anthropology and Psychology of the National Research Council should serve the army of research workers in ways similar to these.

But the analogy breaks down absolutely in one respect. The National Research Council must not, will not, be autocratic. With a representative membership democratically constituted by election from the scientific societies of America it is in no sense our province to dictate, but only to serve. A better analogy compares the National Research Council with the Coordination Branch of the General Staff.

The Division of Anthropology and Psychology of the National Research Council aims to be of service chiefly in three directions: first, assistance in the coordination of research activities already in progress or in contemplation, to encourage team work, minimize duplication of effort, and decrease the magnitude of

[1] Address delivered at Cambridge, December 30, 1919, before a joint session of the American Anthropological Association and the American Psychological Association.

the gaps in our front line of attack on the most vital problems of scientific investigation; second, assistance to the representatives of industries, museums, government departments and other agencies, in the definition of their research problems; and, third, assistance in bringing these agencies into touch with the scientists who are in a position to aid in the solution of their problems.

As Mr. Elihu Root has pointed out, men of science have given to American business and industry the principles underlying a marvellously economical and effective organization; but they have hitherto failed to apply these same principles of organization to their own research activities. While conceding that the production of research output is in essential respects a radically different undertaking from the production of railway equipment or the manufacture of automobiles, we may still insist that in other respects the fundamental principles of organization and of cooperative effort may wisely be directed toward scientific productivity. Such an effort toward multiplication of valuable output is the aim of the Division of Anthropology and Psychology of the National Research Council.

The Division was organized on October 20, 1919, with the following personnel:

Elected by the American Anthropological Association: Franz Boas,[2] Columbia University; Roland B. Dixon, Harvard University; J. Walter Fewkes, Smithsonian Institution; A. L. Kroeber, University of California; Berthold Laufer, Field Museum of Natural History, Chicago; Clark Wissler, American Museum of Natural History, New York City.

Elected by the American Psychological Association: James R. Angell, University of Chicago (chairman, National Research Council); Raymond Dodge, Wesleyan University; Walter D. Scott, Northwestern University and The Scott Company, Philadelphia; C. E. Seashore, State University of Iowa; E. L. Thorndike, Columbia University; G. M. Whipple, University of Michigan.

[2] Dr. Boas resigned his membership in the National Research Council December 30, 1919.

Anthropologists, members at large: A. Hrdlička, United States National Museum; A. M. Tozzer, Harvard University; P. E. Goddard, American Museum of Natural History.

Psychologists, members at large: S. I. Franz, Government Hospital for the Insane; L. M. Terman, Leland Stanford, Jr. University; M. F. Washburn, Vassar College.

Chairman of the Division: W. V. Bingham, Carnegie Institute of Technology; Vice-chairman, Clark Wissler, American Museum of Natural History.

Executive Committee: W. V. Bingham, chairman, Clark Wissler, Franz Boas,[2] J. W. Fewkes, W. D. Scott and C. E. Seashore.

A brief sketch of some of the activities of the Division since its chairman assumed his duties in Washington, November 17, will help in understanding the aims, possibilities and limitations of the Division.

The chairman found himself plunged at once into a swirling eddy of scientific enterprises under discussion by the other scientific and technical divisions of the council. These divisions, with the advantage of several months start over us, had already surveyed their fields, created committees, gone after funds, and settled down to hard work.

On the formulation of some of their projects they sought and welcomed our help. The Division of Biology and Agriculture, for example, had a committee for the formulation of an enormous project for research in South America. Any such project for scientific expeditions and the establishment of research stations might advantageously include in its program plans for archeological, ethnological, and linguistic investigations. Another similar project for oceanographic research among the northern islands of the Pacific was being formulated by the Division of Geology and Geography.

The Division of Biology and Agriculture asked for suggestions of psychological personnel to be included on its Committee on Eugenics. From another source came an inquiry for a consultant competent in the psychology of sex.

The Engineering Foundation had for several

months been formulating a comprehensive program of research on industrial personnel, and welcomed suggestions regarding psychological aspects of the problem.

From two branches of the War Department had come requests for advice and suggestions with reference to the psychological service in the army and the development of tests and standards for use in the new army educational system. An Advisory Committee on Problems of Military Psychology was at once appointed, consisting of Colonel Walter Dill Scott, Major C. S. Yoakum, and Major G. F. Arps. This committee has already been of service, in conference with officers of the General Staff.

These activities of the Division of Anthropology and Psychology are illustrative of a type of usefulness which does not entail the raising or the expenditure of funds. This also holds true of our assistance in formulating a research program for the Washington Diet Kitchen Association, an agency which maintains eight stations to which are brought for examination some 2,000 infants a month. While its research, past and future, focuses primarily on psychological problems of nutrition and growth, it was recognized that here is an exceptional opportunity to gather also data of value in the study of infant psychology, anthropometry and eugenics.

Meanwhile we have been assembling suggestions regarding scientific enterprises toward the promotion of which the Division might wisely bend its efforts. Improvement of facilities for prompt publication of research is a need which several have advanced. Others, particularly among the psychologists, have stressed the growing necessity for a journal to publish a cumulative system of analytical abstracts, such as are available in chemistry, botany and some of the other sciences.

Development of the supply of competent research personnel is another need of our science. This might be accomplished by urging the establishment of more and better fellowships with which to attract and hold for our science the abler minds. Parallel with such a program should go a systematic search for promising student material in the senior classes of the colleges. Such an inventory of talent would be a matter of interest to all the sciences, and should be administered by the Division of Educational Relations. The contribution of our own Division should be merely in supplying the technique of the student survey.

Suggestions regarding specific research projects are being considered. From among them, the Division will select a few of the most promising and important, and bend its efforts toward promoting these. One or more of these projects are to be cooperative undertakings which do not cost money, because the Division wants early to demonstrate its usefulness simply as an agency for correlation of effort. The standardization of procedure in making anthropometric measurements of college students may be a project of this sort.

Other projects of limited scope will require the raising of certain funds as well as the cooperative effort of research workers, such as the determination of the predictive value of various forms of examinations and tests for students entering colleges and engineering schools; or the recording by means of motion picture films of the industries and ceremonies of the North American Indians, to insure a permanent record and permit analytical study of actual movements.

Other proposals are still more elaborate and would call for larger funds. A systematic survey of archeological material and sites in Indiana, Illinois, Iowa and Missouri is an undertaking which could be completed within five years at an annual cost of from $5,000 to $7,000. The function of this Division in such an enterprise would be, first, through a special committee to map out the program in detail, and then, probably through the Division of States Relations on which we are represented by Dr. Fewkes, to encourage state legislatures, historical societies, universities and museums to supply the requisite funds and personnel.

It is intended to select and concentrate on some one major research which is of interest to both anthropologists and psychologists, which can be brought to completion within a relatively short period of one or two years and which gives promise of substantial scientific

results, whose practical value would be generally appreciated. The research problems which best meet these specifications are found within the field of racial differences among the people of the United States. Illustrative of such a project, let me quote from a memorandum by Terman, who suggests securing

> Mental and physical measurements of as nearly as possible unselected representatives of two to four racial stocks represented in the United States, with supplementary social and educational data.
>
> By ordinary methods of selection large numbers would have to be measured in order to insure representative results. The number it would be necessary to measure could, however, be enormously reduced by confining the measurements to children of a given age, say 12-year-olds. Such a group would give more nearly one hundred per cent. availability than any other group that could be selected. Entire villages, counties, or other civil units could be covered in selected parts of the country. The investigations ought to involve measurements of at least 3,000, and preferably 5,000 individuals of each race group. The results would give a fairly reliable cross-section picture in the race groups chosen for study.
>
> Incidentally, also, the study would go beyond any investigation that has been made in the direction of determining the relationship between intelligence and important physical traits *within a given race group*. The method indicated is, I think, the ideal approach to this latter problem, all previous investigations of the problem having utilized faulty methods of selecting subjects.

Other projects similar in scope and promise include a study of the inheritance of intellectual ability; a study of mental and physical variability in selected traits, and the correlation of mental and physical measurements; culture studies of representative community groups as a basis for a rational Americanization program, etc.

Committees of the Division have just been designated, to proceed with the elaboration of specific proposals. One of these committees, on anthropological and psychological study of the people of the United States, will designate subcommittees on specific projects which are deemed most promising and important. Another committee will determine what most needs to be done in order to utilize the immense accumulations of army data which have hitherto been only meagerly studied. A third will formulate programs for specific researches outside the United States, particularly in Tropical America, and in Polynesia where the effects of racial intermarriage are most readily determinable.

It will then be the duty of the Division to see what research agencies, governmental or educational, can be brought to concentrate their efforts toward a concerted attack on these major problems, problems which could not be treated with adequacy by investigators working individually.

These samples will serve to illustrate the major functions of the Division of Anthropology and Psychology; but its usefulness will, I trust, be demonstrated partly in the minor and perhaps incidental services it can render from time to time to individual workers. Requests for aid are frequent and varied. For example, one investigator who has been engaged on plethysmographic research on stutterers has succeeded through wide advertising in locating in another city a trephined stutterer. Two hundred dollars is needed to transport the subject to the laboratory, in order to secure records of fluctuation of blood pressure in the brain during stuttering. Another investigator, studying the phenomena of memory, habit formation and glandular activity under hypnotism, has found a senior medical student with exceptional skill as a hypnotist, who can at will make the hypnotized subject weep out of the right or the left while the other eye remains dry. A thousand dollar fellowship would make it possible to retain this student for a year of service in research.

Unfortunately the council has no permanent funds from which grants and subsidies can be made. Such financial aid as it extends to important projects ordinarily takes the form of an effort to interest a donor in a specific undertaking which has been selected from among many projects, for endorsement by the division concerned.

Nor is the council in a position always to lend its official approval and moral support to

every worthy research undertaking, unless its opinion of the enterprise has first been sought by the government or other agency concerned. But this division will always hold itself in readiness to help any member of these associations, so far as it can, by supplying desired information and particularly by bringing the research worker in touch with other investigators who are engaged on identical or overlapping problems.

One reason why Germany, fighting against the world, was able to stave off defeat for four long years, is that she had to a remarkable degree mobilized her scientific brains. To the same marvellously planned and coordinated development of science in its applications to production, is traceable the world leadership she had won in many phases of industry.

What Germany was able to do under an autocratic régime in the way of fostering scientific investigation and making the results of research in pure and applied science of value to government and industry, it is distinctly up to America to do in a democratic way.

E. B. Woods, the distinguished sociologist, observing the trends of human progress, recently remarked, "The past fifty years have belonged to the men who could organize material production, but the present and the future belong to those who can organize men." He was evidently thinking of the organization of activities in public affairs, in religion, in business and manufacture, in labor relations, and in all movements for human betterment. A third group of leaders to whom both of these groups will turn for guidance consists of those who can organize ideas. I conceive it as a prime function of the National Research Council to organize American men of science for multiplied productivity in the organization of ideas. To such a program of cooperative effort within the enormously important branches of the sciences of man, the Division of Anthropology and Psychology of the National Research Council is dedicated.

W. V. BINGHAM

WASHINGTON, D. C.

THE TECHNOLOGY PLAN

THE Technology Plan is an organized attempt to effect a closer cooperation between scientific and industrial effort; between the technical school and the individual industry throughout the country. Although a working relationship between educational institutions and industrial organizations has been discussed at great length, and on many occasions, little real practical progress has as yet been made.

The Technology Plan recognizes that for the present, at least, there must exist somewhere in this scheme of cooperation an element of individual and mutual responsibility on the part of those engaged in it. It recognizes that a purely philanthropic enterprise does not engender in the managers of industry that confidence which is an essential element in its success. Such men are not yet deeply interested in a strictly *pro bono publico* method of cooperative work. Hence, the Technology Plan is neither eleemosynary in organization nor philanthropic in its aims and methods.

The essential feature of the plan is an agreement, expressed as a contract, between individual industrial organizations and the Massachusetts Institute of Technology, under which the industry pays an annual retaining fee to the institute, in return for which the institute assumes certain definite obligations of such a character as it is in position to meet. These obligations are in very general terms as follows:

The great demand of the industries to-day is for men trained to solve the many problems with which these industries are confronted. This requires, first, a knowledge of the principles of science, and second, a training in the application of this knowledge to the solution of the ever-recurring difficulties. While the first requirement is reasonably well met by the undergraduate courses of instruction at the institute, only to a limited extent can the second be obtained in the four years allotted to undergraduate work. The student must be encouraged to spend an additional year or more in a research laboratory or advanced study. Since the best way to learn an art is

to practise it, the student is best taught to solve industrial problems by having him attempt the solution of such problems under able and experienced guidance. These problems, however, have their origin in, and owe their existence to, the industries themselves. The first point of cooperative contact, therefore, in this arrangement between industry and the Institute of Technology is that the institute agrees to use, so far as it can, such problems as the industry will submit to it as basic material for its research work for those graduate students interested in industrial development; to give men already well grounded in science the benefit of the opportunity of working under experienced instructors upon the type of work for which they are urgently required. It is true also that much investigation in "pure science" can be conducted as profitably in fields of research which are closely akin to industry as in those realms of science far remote from general interest. This does not mean that the search for knowledge for its own sake will not continue to subtend a large arc of the activities of the Institute of Technology; but rather that such search will be activated and inspired by the realization that the hard work involved and the results obtained are recognized as an essential part of a comprehensive whole. Hence, the institute agrees in its contract to maintain a steady stream of trained men constantly flowing into industry with the best preparation for scientific work which it is possible for it to give. At the same time, the results of the research work thus obtained will swell the store of knowledge on which the scientific progress of the community, as a whole, depends.

But a corollary of this duty of preparing educated men is the duty to see that, as far as possible, these men take positions for which their natural ability and aptitude most nearly fit them. Further, it is desirable that, as these men develop into specialists in any particular field, their sphere of usefulness be made wide as is practicable. Hence the institute undertakes to maintain a record of the qualifications, experience and special knowledge of its alumni; to advise the contractor where such knowledge and experience as it seeks is available; to assist the contractor to obtain the technical help he requires, whether from its own alumni, or from available engineers elsewhere. While this service has been rendered to some degree in the past, it has been a minor part of, and incidental to, other activities. It will now become a contractual obligation.

Coincident with the education of scientific men, there exists the necessity of educating the executives of the industries in the great economic value of science when applied to the business of their organizations. The sporadic "Yankee genius" of the past, productive though it was, must be replaced by the methods of scientific research. Genius must be provided with that most efficient tool yet produced —scientific method. While it is true that the world will ever need more knowledge, the pressing duty of industry for the present is to apply the knowledge now available. To meet this situation, the institute provides for conferences with members of its staff, not only in its own building but also at the factories of the contractor. It is hoped that the contractor will be so imbued with the possible benefits to be derived by the application of science that he will avail himself of one of the sources of technical aid readily accessible, not only at the institute, but among consulting engineers and industrial scientists throughout the country. A realization of that close cooperation between the industrial interests and the educational institutions of the country, which in Germany was made so effective by the domination of both by the state, can, in America, be brought about only by a voluntary personal relationship between the executives of the companies and the instructing staffs of the institutions. The Technology Plan aims to make this relationship more easily possible; to provide a point of contact between the two interests; to open a channel of communication through which the manufacturer and the technical consultant can more easily meet. The contractor can obtain the value of his retainer only by utilizing the facilities thus made available. There will, therefore, be present in the Technology Plan this incentive, to at least try.

The instructing staff of an educational institution is made up, at least theoretically, of men peculiarly adapted to render great public service by conducting research of a fundamental character, *i. e.*, they are seekers after new knowledge, and yet, at the same time, are teachers and trainers of young men. It is important that these men be not withdrawn into purely industrial work by reason of the greater financial return offered by great corporations, or the acute pleasure which many red-blooded men feel in being professionally connected with great technical developments. Hence, the Technology Plan provides a method by which the staff is enabled to profit by contact with men of affairs and receive the inspiration which comes from the capitalization of effort, and, at the same time, fertilize and capitalize the instructional work of the teaching staff.

The institute, therefore, agrees that if the contractor has special technical problems requiring extended consultations, investigations, test, or research work, it will advise the contractor where and by whom such service can best be rendered. When one considers the splendid laboratories with which the Institute of Technology is equipped, covering as they do, almost every department of applied science, and its staff, trained in the use of such laboratories, it is obvious that much of the work will be done within its own organization. But it is neither the desire nor the intention of the Technology Plan to limit the contractor to the facilities of the institute. It is the hope of the Division of Industrial Cooperation and Research, the organization set up to handle the one hundred and ninety contracts already made, that it can enlist the interest of the great body of able consulting engineers throughout the country. When, therefore, consultations, tests, investigations, or research work are of such a nature as can be best furnished by established commercial organizations, the institute will advise the contractor where, in its judgment, the work can best be cared for.

The Technology Plan is, therefore, a more effective means of introducing technical research to the manufacturer; of making the application of science to industrial problems popular; of creating an appreciation on the part of the leaders of industry of the value of science and the necessity of providing, not alone for its application, but for its continued growth and development.

It is earnestly hoped that the plan here outlined will be adopted with improvements by other educational institutions for the benefit of both education and industry.

WILLIAM H. WALKER
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

DOLOMIEU

WE have again to thank Professor Alfred Lacroix, of the Académie des Sciences, for the publication of a manuscript account by the French mineralogist Déodat Dolomieu of his travels in Sicily in the year 1781.[1]

Dolomieu, who was a Knight of Malta, had in 1771 incurred the displeasure of the Grand Master of the Order on account of his participation in a duel, and was obliged to absent himself from the island for several years. During this time he came to Paris, where he became acquainted with many of the leading scientists of the period, and frequented much the Jardin du Roi, the forerunner of the present Jardin des Plantes. The mineralogist Daubenton urged him to undertake a geological trip to the island of Sicily and gave him much valuable advice as to the observations he could make there. In a letter written June 9, 1776, to his patron, Duke Alexandre de La Rochefoucauld, Dolomieu says that by pursuing his investigations under the guidance of Daubenton's notes, he believes that he would be able to make a collection of characteristic marbles, which he would gladly share with the duke (p. 7).

By 1779, Dolomieu had made his peace with the Order of Malta, and had returned to the island, whence he started in 1781 for his trip to Sicily (p. 8). In a letter of August 6 to his friend Chevalier Gioeni, a distinguished nat-

[1] "Un voyage géologique en Sicile en 1781, notes inédites de Dolomieu," by Alfred Lacroix, Secrétaire Perpétuel de l'Académie des Sciences, Paris, Imprimerie Nationale, 1919, 190 pp. 8vo.

uralist of Catania, Sicily, Dolomieu gave in the following brief paragraphs the main results of his explorations (pp. 10, 11):

1. I found no trace of volcanoes anywhere in the Val Demona. The neighborhood of Ali does not offer any volcanic material; the waters which supply the hot baths established on the coast are the only indications I have found of subterranean fires.

2. The Liparian Islands are exceedingly curious, and they well merit the attention of naturalists. An interesting collection could be made here of lavas and other volcanic products, but I did not have time to accomplish this.

3. The mines of Val Demona are grouped in a triangle of mountains which occupy the promontory of Sicily; all the veins traverse schist. They contain silver, copper, lead, antimony, zinc and mercury. But none of these mines have been exploited and it is almost impossible to get specimens. In my whole journey through these mountains I was only able to pick up a few pieces which I took from the outcrops of the veins.

4. The granites are present in great quantity in the mountains of Messina, and I believe that a part of the columns made of this rock which one sees in Sicily were quarried in these mountains.

5. I do not know whether there are real coal mines at Messina. I have only found a bituminous earth very common throughout Sicily.

We may note that Dolomieu was enough interested in the report that there was a deposit of beryls near the village of Gratteri, to visit the place. The locality was in a ravine which traversed a hill. Here a number of geodes had been found, resembling those of Grenoble in France. They had a triple envelop of black iron-ore, brown iron-ore and gray clay, and some of them displayed within polyhedral, transparent crystals. Dolomieu could only find a few unsatisfactory specimens, and was forced to buy some at Gratteri, where he had to pay as much for them as for genuine beryls. In reality they were either hyalin quartz, or the light-blue strontium sulphate called celestine (pp. 90, 91).

Déodat Dolomieu was born at Dolomieu, near Tour-du-Pin, in Dauphiné, France, on June 23, 1750. He died at Châteauneuf, near La Clayette, department Saône-et-Loire, November 16, 1801. Regarding the disposition of his remains, the following information is given by Professor Alfred Lacroix in his biographical sketch of Dolomieu.[2]

Dolomieu was interred at Châteauneuf, near La Clayette (Saône-et-Loire). His body probably rests in the vault of the Drée family, but his heart was placed in an urn (39.2 cm. × 23.6 cm.) of black porphyrite with large crystals of white feldspar, which surmounts a fine prism (1 m. 29.8 × 21.6 cm.) of basalt from Auvergne, itself supported by a pedestal of Albanese peperino and marble (violet breccia). This little monument, which formed part of the collection of his brother-in-law (Catalogue of the eight collections composing the Mineralogical Museum of the Marquis Etienne de Drée, Paris, 1811, p. 249), finds itself to-day placed at the entrance of the mineralogical gallery of the Muséum d'Histoire Naturel in Paris.

At the request of the Marquise de Drée, her brother's heart was, at the time of her demise, transported to her own tomb at Dolomieu. In the park of the chateau of Châteauneuf, she had caused to be erected a small monument formed by a block of the red granite of the country.

George F. Kunz

SCIENTIFIC EVENTS

THE MACKENZIE DAVIDSON MEMORIAL

An influential English committee has issued an appeal which in part says:

The death of Sir James Mackenzie Davidson in the prime of life has deprived radiology of one of its most distinguished exponents, whose name is specially associated with the development of radiographic technique, and particularly that of stereoscopic radiography, and with the introduction in this country of the method of the localization of foreign bodies to which so many thousands of wounded men owe a deep debt of gratitude.

Mackenzie Davidson's reputation was international. In this country he was rightly regarded as the head of his profession, and throughout his career he was unsparing in his efforts to raise the

[2] "Notire historique sur Déodat Dolomieu," Paris, 1918, p. 83, note 85; Institut de France, Académie des Sciences.

status of radiology among the sciences. He was especially insistent on the fundamental value of physics to radiology, particularly in regard to methods of measurement and the designing of equipment, subjects in which he was deeply interested up to the time of his death.

Many in his own branch of the profession and a number of his friends and former patients, wishing to keep his memory green, have suggested that an appeal for funds should be made to found a Mackenzie Davidson Chair of Radiology at some university.

Had Mackenzie Davidson lived he would have been among the first actively and generously to support the foundation of an institute for teaching and research in radiology, of which he was one of the earliest pioneers. If funds permit, it is hoped to found such an institute, to which possibly the chair could be attached, and of which the personnel and equipment would be beyond reproach. The benefit accruing to the British School of Radiology would be incalculable.

Till quite recently radiology has been regarded as a purely medical subject, but experimental research has shown that X-rays may be profitably employed commercially in a number of industries. A new subject, radiometallography, has, for example, come into being, which offers great possibilities for examining the internal structure of metals and other materials. In this connection radiology has already been turned to account by the steel manufacturer, the metallurgist, the engineer, the manufacturer of explosives, the aircraft constructor, the glass manufacturer, etc.

The future of radiology will therefore lie, not only in the fight against disease and suffering, but also in the increase of commercial and industrial efficiency. But these new branches of radiology need much investigatory work before they can come fully into their own, and a chair of radiology associated with an X-ray institute should play a worthy part in such development.

THE ENGLISH UNION OF SCIENTIFIC WORKERS

Nature reports that the half-yearly council meeting of the National Union of Scientific Workers, presided over by Mr. G. S. Baker, of the National Physical Laboratory, was held at University College on March 6. The rapid growth of the union has necessitated the appointment of a full-time secretary, and Major A. G. Church has been appointed to fill that office. The research committee in its report outlined the function of this body and that of the research council, which it is hoped will shortly be constituted. It will consider how best industry and public administration should be kept in close touch with the development of scientific knowledge, and ensure that the views and conditions of employment of scientific workers shall receive consideration from all bodies bringing forward schemes for research in science or for the administration of research. It was felt that the state should not subsidize industrial research associations unless such bodies display an anxiety to ensure that the direction of research shall be in the hands of those who have shown capacity for leadership in scientific work. A report on patent rights presented by Mr. A. A. Griffith emphasized the opinion "that the only satisfactory way of remunerating salaried inventors is to pay them adequate salaries; a salaried inventor receiving an adequate salary should have no claim whatever to any extra payment because his work proves unexpectedly remunerative." On the motion of Miss A. B. Dale, the council unanimously agreed to "protest against the differential treatment of men and women as regards the method of recruitment to the Civil Service and the salary scales offered therein as recommended by the Reorganization Sub-committee of the Civil Service National Whitley Council."

THE HARVARD ENGINEERING SCHOOL AND INDUSTRIAL COOPERATION

THE Harvard Engineering School has adopted a new plan of instruction for the junior year of the engineering course, whereby students will hereafter be given an opportunity to combine classroom work with six months of active engineering practise and industrial training. According to the new plan, which will be inaugurated in June and will apply to the instruction in mechanical, electrical, civil, sanitary and municipal engineering, every student who wishes to take the industrial training work will spend half his time during his junior year working in industrial or engineering plants within easy reach of Cambridge.

Professor Hector J. Hughes, chairman of the administrative board of the engineering school, has made the following statement:

One of the first problems which the staff of the new engineering school set itself to solve was to find an effective way of getting the new school and its students into closer relations with industrial and engineering work before they graduate. The need for such relations has been increasingly evident in the past few years. The object of such coordination is manifold: to stimulate interest in the classroom work; to keep the teaching staff well-informed of the needs of industry and how to train engineers to meet them; to give the students some intimate knowledge of the great problems of labor and industry which they have to meet after they graduate, and thus to anticipate to some extent the period of initiation which all students must go through and better to fit them to begin their careers; to give them an opportunity to discover how intricate and interesting the basic industries are and to what extent scientific knowledge may be used in work which is too frequently looked upon as non-technical; in other words, to find out how many kinds of careers are open to technically trained men and how wide is the opportunity for such men. Another object of the new plan is to stimulate the interest of the industries themselves in the adaptation to their special needs of education in engineering.

The most promising solution of this problem seemed to the staff to lie along the lines of the highly developed and successful plan of industrial cooperation which was initiated by Dean Schneider at the University of Cincinnati and has been carried on there so successfully for many years, and has been applied in a modified form at the University of Pittsburgh also. This plan has been modified still further to meet the different conditions and needs at Harvard. It is significant that other universities are now moving in the same direction, and within only a few days a large movement has been inaugurated to put such a plan ultimately into effect in most of the large technical schools.

After a thorough study of the situation, the staff came to the conclusion that it would be highly desirable to offer our students an opportunity to get some industrial experience and engineering practise while undergraduates but without sacrifice of classroom instruction and without depriving them of the many advantages which attach to residence and study under teachers interested in other subjects than science, and among students of widely differing interests. In other words, we feel that our students should have as many as possible of the benefits which we know will come from connection with the college, while they are at the same time carrying on their engineering studies. For this reason, and because it does not seem desirable to lengthen the period required for a first degree beyond four years, we shall be limited at the outset to less industrial experience than perhaps would be desirable. The amount offered, however, should be looked upon as a minimum and we have no doubt that many of our students will be glad to avail themselves of the opportunity to take more of this work after the plan is in operation.

Mr. H. V. Drufner, of the University of Cincinnati, has been secured to take active charge of the technical work of putting the new plan into operation.

THE FOREST CLUB CONVENTION IN NEW HAVEN

The fourth annual convention of the Intercollegiate Association of Forestry Clubs was held in New Haven on Friday and Saturday, February 27–28, under the auspices of Yale, the present president club. There were twelve delegates present of whom two were from the Pacific coast. The meeting was in every way a distinct success and the sessions were well attended. Owing to the number of Yale alumni present the occasion partook of the nature of a reunion.

Among the business transacted at the meeting was the adoption of insignia for the association, the provision for a quarterly publication to be issued by the president club, and the election of the University of California as president for the coming year. The next convention will accordingly be held in Berkeley.

The following is the list of speakers and the subjects of their papers:

February 27

The profession of forestry: Professor H. H. Chapman, New Haven, Conn.

How can the forester help the lumberman? T. L. Bristol, Ansonia, Conn.

The work of the consulting forester: J. T. Rothery, New York City.

Speakers at the Banquet

Dean Toumey, Colonel Woolsey, Major Marston, E. C. Hirst and Mr. Rogers, of the Indian Forest Service.

February 28

The undergraduate student of forestry: J. H. BRISCOE, Orono, Maine.

The student of forestry and state service: E. C. HIRST, Concord, N. H.

The student of forestry and research: S. T. DANA, Washington, D. C.

MEETING OF THE INTERNATIONAL EUGENICS CONGRESS IN NEW YORK CITY

THE National Research Council has appointed a committee on eugenics, under the division of biology and agriculture, consisting of the following members: L. F. Barker, A. G. Bell, E. A. Hooton, Daniel W. LaRue, Stewart Paton, Raymond Pearl, R. M. Yerkes, H. S. Jennings and C. B. Davenport, chairman. The committee met on March 20 and voted to hold the Second International Eugenics Congress in New York City, September 22 to September 28, 1921, inclusive. The invitation of the American Museum of Natural History to hold the meetings of the Congress was gratefully accepted. Dr. Alexander Graham Bell was elected honorary president and Dr. Henry F. Osborn, president. Madison Grant is treasurer and Mrs. Sybil Gotto, secretary of the Eugenics Education Society, in view of her activity in organizing the First Eugenics Congress, was named as honorary secretary of the Second Eugenics Congress. The nucleus of a general committee for the Second International Congress was elected. This general committee is to meet in New York on Saturday, April 10. To this general committee are entrusted the details of organizing the congress, of arranging the program of the meeting, of providing for the entertainment of guests and the raising the necessary funds. The national consultative eugenics bodies in the various allied and associated countries will be informed of the action of the eugenics committee of the National Research Council and invited to send representatives. A general invitation will be sent to universities in different American countries and in various countries of Europe.

SCIENTIFIC NOTES AND NEWS

THE American Institute of Electrical Engineers will confer the Edison Medal, awarded each year for the most noteworthy advance in electrical engineering, on Mr. William Leroy Emmet, consulting engineer of the General Electric Company, for his work on the electric propulsion of ships.

DR. E. W. BROWN, professor of mathematics in Yale University, received the Bruce Medal of the Astronomical Society of the Pacific, at a meeting in San Francisco on March 26.

THE University of Dublin has conferred the degree of doctor of science on Professor R. A. Millikan, of the University of Chicago.

DR. J. M. T. FINNEY, Johns Hopkins University, and Dr. Charles H. Mayo, Rochester, Minn., have been elected honorary fellows of the Royal College of Surgeons. It is hoped that they may be able to attend the meeting of the council in July for the presentation of diplomas.

SIR JAMES DEWAR has been elected a corresponding member of the French Academy of Sciences in the section of general physics in succession to the late Professor P. Blaserna.

PROFESSOR HORACE LAMB, Sir Thomas L. Heath, Professor W. H. Bragg and Dr. Henry Head have been elected honorary fellows of Trinity College, Cambridge.

DR. BRADFORD KNAPP, chief of extension work in the South, States Relations Service, U. S. Department of Agriculture, since 1911, has been appointed dean of the college of agriculture, of the University of Arkansas and director of the experimental station, and chief of the department of rural economics. Martin Nelson has been appointed vice-dean and vice-director and chief of the department of agronomy.

DR. J. STANLEY GARDINER, F.R.S., professor of zoology in the University of Cambridge, has, at the request of the deputy minister of fisheries, undertaken temporarily the direction of

the scientific work of the Fisheries Department of the British ministry.

Mr. H. F. Fish, formerly in the research department of the Great Western Sugar Co., Denver, Colorado, has been appointed by the board of trustees of the University of Illinois as special research assistant in the joint investigation of the fatigue of metals.

Mr. Harvey Bassler, who has held a temporary appointment on the U. S. Geological Survey since 1911 while a student at Johns Hopkins University, has joined the permanent staff of the survey as assistant geologist, and has been engaged in field work in the Virgin River Oil Field, Utah.

Mr. Albert D. Brokaw, formerly associate professor of economic geology and mineralogy at the University of Chicago, has opened a New York office for the practise of his profession as consulting geologist.

Mr. Philip A. Macy, assistant chemist at the Florida Experiment Station, has accepted a position with the Florida Agricultural Supply Co.

The following officers and council of the Geological Society, London, have been elected for the ensuing year: *President,* R. D. Oldham; *Vice-presidents,* Professor E. J. Garwood, G. W. Lamplugh, Colonel H. G. Lyons and Professor J. E. Marr; *Secretaries,* Dr. H. H. Thomas and Dr. H. Lapworth; *Foreign Secretary,* Sir Archibald Geikie; *Treasurer,* Dr. J. V. Elsden; *other Members of Council,* Dr. F. A. Bather, Professor W. S. Boulton, R. G. Carruthers, Dr. A. M. Davies, J. F. N. Green, R. S. Herries, J. Allen Howe, Professor O. T. Jones, Professor P. F. Kendall, W. B. R. King, Dr. G. T. Prior, W. C. Smith, Professor H. H. Swinnerton and Professor W. W. Watts.

Friends of Professor Chandler presented in 1910 to Columbia University a sum of money which constitutes the Charles Frederick Chandler Foundation. The income from this fund is used for a lecture by an eminent chemist and to provide a medal to be presented to the lecturer in further recognition of his achievements in science. Previous lecturers on this foundation were L. H. Baekeland, Sc.D., and W. F. Hillebrand, Ph.D., The lecturer this year will be Willis Rodney Whitney, director of the Research Laboratory of the General Electric Company, a former president of the American Chemical Society and of the American Electrochemical Society. Dr. Whitney's subject will be "The littlest things of chemistry." His lecture will be in Havemeyer Hall, Columbia University, at 8:15 P.M., on April 27.

Dr. D. T. MacDougal, of the Carnegie Desert Laboratory, at Tucson, Arizona, gave a lecture in El Paso on March 10 on "Travels in the Lybian Desert," and on March 12 Dr. A. E. Douglass, of the University of Arizona, Tucson, gave a lecture in Albuquerque, N. M., on "The Big Tree and its Story." These lectures were given in connection with the proposed formation of a Southwestern Division of the American Association for the Advancement of Science.

Dr. Edgar T. Wherry, of the Bureau of Chemistry, U. S. Department of Agriculture, delivered an address before a joint meeting of the Washington Academy of Sciences and the Chemical Society of Washington on "Soil Reaction and Plant Distribution," on March 25.

At a meeting of the Aeronautical Society of America in conjunction with the American Museum of Natural History on March 25 brief addresses on aerial photography applied to exploration, map making and physical geography were made by Colonel Edgar Russell, U. S. Signal Corps, Sherman M. Fairchild, Carl E. Akeley and representatives of the U. S. Geological Survey.

A memorial meeting to the late Sir William Osler, regius professor of medicine at Oxford University and for many years professor of medicine at Johns Hopkins University, was held on March 15 in Johns Hopkins University. President Frank J. Goodnow presided and addresses were made by Henry Van Dyke, D.D., and Professor William H. Welch. A correspondent writes: In the *Wiener Klinische Wochensschrift* of February 26, 1920, Dr. K. F. Wenckebach has an admirable obituary of

the late Sir William Osler, in which he emphasizes the genial cosmopolitan spirit of this great physician. It appears that Osler was the first physician to inquire into the rumors concerning the economic condition of the Viennese population after the war and the first to take measures for the relief of the starving Viennese.

DR. JAMES GAYLEY, past president of the Institute of Mining Engineers, has died at the age of sixty-five years.

PROFESSOR ERNEST M. JORDAN, a member of the faculty of the Boston University Medical School since 1913, and a specialist in nervous diseases, died on March 15.

PROFESSOR CHARLES LAPWORTH, for many years professor of geology and physiography in the University of Birmingham, died on March 13 at the age of seventy-seven years.

DR. PIER ANDREA SACCARDO, emeritus professor of botany in the Royal University of Padua, and long director of the Botanical Garden of that city, has died at the age of seventy-five years.

WORD has been received of the death on December 13 last, of Professor Woldemar Voigt, the eminent mathematical physicist of the University of Göttingen, at the age of sixty-nine years. Being a man of broad mind with friends in all the warring countries, he suffered keenly throughout the war and this is said to have aggravated the heart trouble which was the immediate cause of his death. His writings include papers and books in many fields of physics, but chiefly in magneto-optics and crystal physics.

THE Carnegie Corporation has given to the American College of Surgeons $75,000 to be used for hospital standardization. The present gift is the second which the corporation has made to the college. In 1916 it gave $30,000, making a total now of $105,000 for hospital standardization. This amount is supplemented by funds of the college.

THE Institute of Research in Animal Nutrition at Aberdeen has received a gift of £10,000 from Mr. J. Q. Rowett. The amount required from public sources for the establishment of the institution is £25,000.

THE Biological Laboratory of the Brooklyn Institute of Arts and Sciences will hold its thirty-first session during July and August. Investigators can find accommodation at any time during the summer. The usual courses are offered in field zoology by Drs. Walter, Kornhauser and Parshley, in comparative anatomy by Dr. Pratt, systematic and field botany by Drs. Harshberger and Stiteler and beginning advanced work under the direction of the various instructors. The Eugenics Record Office, Carnegie Institution of Washington, takes advantage of the arrangements for boarding students at Cold Spring Harbor to give its training course for field workers in eugenics at the same time with the session of the Biological Laboratory (Drs. Davenport and Laughlin.) The announcement for 1920 can be secured by addressing the Biological Laboratory, Cold Spring Harbor, L. I.

DURING the period of the Christmas meetings of the American Association for the Advancement of Science, an anthropological society was organized in St. Louis, largely under the stimulation of Dr. Aleš Hrdlička who visited the city at that time. The object of the society as stated in the constitution is the promotion of research in all branches of anthropology. The officers are: *president,* Professor R. J. Terry; *vice-president,* Dr. H. M. Whelpley; *secretary-treasurer,* Dr. C. H. Danforth, *councilors,* Drs. W. W. Graves, Albert Kuntz, R. Walter Mills, Sherwood Moore, Daniel M. Schoemaker and Mr. J. Max Wulfing. Two regular meeting have been held. At the first Dr. R. Walter Mills presented a paper on "Variation in Physicial Type and Visceral Function," and at the second Dr. H. M. Whelpley spoke on "Notched Indian Hoes, The Most Specialized of Indian Agricultural Implements."

UNIVERSITY AND EDUCATIONAL NEWS

THE Medical College of the state of South Carolina has received an appropriation of

$71,000 from the state for maintenance, as compared with $49,500 last year. An additional appropriation of $60,000 was made for a physiology building and equipment.

The proposal to admit women to be fellows of the Royal College of Surgeons of Edinburgh after examination, on the same conditions and with the same privileges as men, has been accepted.

Dr. H. Monmouth Smith, who is at present assistant director of the Carnegie Nutrition Laboratory in Boston, and who was formerly connected with Syracuse University, has been appointed a professor of inorganic chemistry at the Massachusetts Institute of Technology.

Professor Frank C. Whitmore, of the University of Minnesota, has succeeded Professor Harry A. Curtis as professor of organic chemistry in Northwestern University, Evanston, Ill.

Mr. J. D. Black has been appointed professor and chief of the division of agricultural economics at the University of Minnesota, in the place of W. W. Cumberland, whose leave of absence for service in Turkey as financial and economic adviser to the commission to negotiate peace between the Allies and Turkey has been continued for another year.

Mr. A. Amos, of Downing College, has been appointed lecturer in agriculture in Cambridge University.

Dr. Hugo Fuchs, professor of anatomy at the University of Königsberg, has been transferred to the University of Göttingen, succeeding Professor Merkel.

DISCUSSION AND CORRESPONDENCE

THE ATTAINMENT OF HIGH LEVELS IN THE ATMOSPHERE

In the March 19, 1920, issue of Science appeared an article by Alexander McAdie, entitled "The Attainment of High Levels in the Atmosphere." As certain incorrect statements which are detrimental to the Curtiss Aeroplane & Motor Corporation appeared therein the following correction is made. No criticism of Professor McAdie is intended, nor any desire on his part to misstate a fact is in any sense suspected.

Unauthorized statements are made in the press, the results of which are far reaching. One of these is the innocent acceptance of them by Professor McAdie as being correct and the corresponding reappearance of the incorrect values in the above mentioned article.

On September 18, 1919, Roland Rohlfs, the test pilot of the Curtiss Engineering Corporation, made an altitude flight, obeying in every particular the official rules laid down for such contests. It should be stated here that the compliance with these rules is a serious handicap and in justice the same conditions should be observed by all competitors.

The flight was made in a Curtiss triplane fitted with a K-12 motor without supercharger and without the use of special fuel. The result obtained from the barograph chart by the Bureau of Standards after all corrections for instrumental errors had been made was 34,910 feet, this value being, however, uncorrected for the average temperature of the air column. The instrumental corrections to the barograph readings were determined by subjecting the instrument to the same variations of pressure and temperature in the laboratory as those encountered during the actual flight.

The value of 34,910 feet, although uncorrected for air temperatures was homologated, this being strictly according to the 1919 rules and was of interest for comparison with the French altitude flight of Jean Casale made June 14, 1919, which was calculated by the same method.

It is well known that this way of expressing results, that is, without air temperature corrections, is not only unsatisfactory and unfair but also scientifically incorrect and the Curtiss Company has always admitted that the true (tape line) altitude reached by Rohlfs became 32,450 feet when the air temperature correction, also made by the Bureau of Standards, was applied. There is thus a large but proper reduction in the indicated altitude. This correction is the larger the colder the air encountered in the flight.

It may be noted here that the undersigned was at least partially instrumental in awakening interest in the unsatisfactory official rules, the result being that both the Bureau of Standards and the homologating body sent representatives to Europe with a view of putting the rules on a fairer and more scientific basis.

The outcome is that the rules are greatly improved but are still open to proper criticism and objection. It is necessary, however, for all either to accept the rulings of the official body or, if they are to be ignored, for all to work on the same unbiased scientific basis and abide by the decisions of an authoritative and independent scientific laboratory such, for example, as the Bureau of Standards at Washington.

In order to bring out clearly an important point in this matter, that is, the importance of the air temperature correction, assume that two identical perfect barographs with no instrumental errors are taken up, one in the summer time and the other in winter, to such an altitude that both read say 8 inches of mercury as the minimum pressure. Assume also that the average temperature of the air is in the first case —10° C. and in the second —30° C. which values correspond closely to actual observed figures.

The true altitudes corresponding to this pressure are in the first case 33,475 feet and in the second 30,929 feet, although the altitude uncorrected for air temperature is the same for both, *i. e.*, 36,020 feet. These figures are obtained from Circular No. 3 of the Aeronautic Instruments Division of the Bureau of Standards and are within ½ per cent of the true values. The correction for the first case is —2,545 feet and is twice as much for the second, or 5,091 feet. The value 36,020 feet assumes that the air is at a uniform temperature of —10° C throughout. As stated above Rohlfs' record reduced in this manner by the Bureau of Standards gave a true altitude of 32,450 feet.

We now quote from the Air Service News Letter No. 11, issued by the Information Group, Air Service, of March 9, 1920.

> The purpose of this letter is to keep the personnel of the Air Service both in Washington and in the field informed as to the activities of the Air Service in general and for release to the public press. At an indicated altitude of 36,000 feet . . ., the temperature at his greatest altitude was 67 degrees below zero F. . . . The preliminary calibration of the barograph indicates that the airplane reached a pressure of eight inches of mercury which corresponds approximately to 36,000 feet on the Bureau of Standards altitude chart.

In commenting on this letter we note that it does not claim that a record was obtained. We ask then by whose authority a record is granted and published as such. We note also that approximately 36,000 feet corresponds almost exactly to the stated minimum pressure of eight inches of mercury, which shows that this value has not been corrected for air column temperature. The ground temperature is not stated but the Weather Bureau kindly furnished us with the values, max. + 18° F., min. + 13° F. for Dayton, Ohio, February 26, 1920. Using the most favorable value, *i. e.*, + 18° F., for the McCook Field flight, the average is —31.4° C., which gives a correction, using the Bureau of Standards tables of —5,269 feet and hence the true altitude is not 36,020 feet (as published) but is 30,751 feet.

This altitude does not reach that of Rohlfs by 1,700 feet, figured on the same basis, and as according to the rules for beating a record it should surpass it by 328 feet (100 meters) it lacks 2,027 feet to beat Rohlfs' record.

It is not surprising then that the Curtiss Company wished to protest the validity of this new record. The premature announcement in the press that Major Schroeder has beaten all altitude records with a flight to 36,020 feet, beating the previous one held by Rohlfs, is neither justified by the figures, nor authorized by the Army bulletin nor fair to the Curtiss Company's machine and motor nor just to its pilot, Mr. Rohlfs. Slightly modified results were given personally to the writer at a meeting which he had with Major Schroeder, showing an uncorrected altitude of 36,118 feet and a true altitude of 30,835 feet.

The Curtiss Company will be among the first to acknowledge a properly authenticated record beating the one it now holds and in a true competitive spirit and for the benefit of aviation attempt to better it at the first opportunity.

J. G. Coffin,
Director of Aeronautical Research
Curtiss Aeronautical & Motor Corporation,
Garden City, L. I., N. Y.

CONCERNING BALLISTICS

To the Editor of Science: For sufficient reasons I was unable to attend the meeting of the American Association, and so was not so fortunate as to hear Major Hull's very valuable and interesting address on ballistics, nor Professor Ames's extremely scholarly and clear address on Einstein's theory. However I have read Professor Hull's address in Science with great pleasure. In it he is good enough to speak of my pressure gauge for guns, but says that its use appears to be limited to the cases of guns that can be rigidly clamped during the explosion. I hope to demonstrate shortly that there is no such limitation. Over a year ago I was offered the use of a six-inch gun at Aberdeen to put my gauge on, and Admiral Earle has at last taken an interest in my results and has manifested a willingness to assist me. The coming of the armistice, however, removed so much money and personnel from Aberdeen that nothing came of it.

I should have been pleased if Major Hull could have seen fit to call attention to the fact that I was the first person to publish trajectories of "la grosse Berthi" that bombarded Paris two years ago. The bombardment began on March 23, 1918. The next week I began to deliver lectures on exterior ballistics, and in a few days we had a number of trajectories calculated. In four weeks from that date I read a paper at the meeting of the American Philosophical Society in Philadelphia, at which I showed a number of trajectories. I used the height function for the density as given in Major Hull's address, and at that time it had never been used by either the United States Army or Navy. I showed my results to Major Moulton, who was just beginning his distinguished service in the army, and he showed much interest. Later he advised me not to publish them, as such calculations were now "a matter of routine."

I reminded him that although they may be such now, they were not when I read the paper. I have also seen in French journals pictures with articles apparently written by experts which would lead one to believe that there are discontinuities in the atmosphere, or that it stopped suddenly a few miles up. In a recent letter from M. Henri Le Chatelier, regarding my paper, he says that the French had made guns with an initial velocity of 1,200 meters per second, but had not thought of using them for high fire, as they were intended for penetration of ships armor. We also constructed curves showing the decrease of density upon both the isothermal and adiabatic hypotheses, neglecting and taking account of the variation in gravity, as given in my book on Dynamics, and also the observed values as kindly furnished me by Professor Humphreys. Unfortunately I was requested to keep the number of figures down, and these were not printed. I should be glad to send the paper to any one interested. The gauge paper is unfortunately exhausted. I may say that M. Sugot, the chief engineer of the Commission de Gâvre, told me last summer that ballisticians had been waiting fifty years for my instrument, and that the publication of my curves had rendered useless all the theoretical work of ballisticians on interior ballistics. Of course that is not so, but I hope next month to show how this gauge answers all questions that can be asked on the subject. I think I was the first professor to give lectures on ballistics, both interior and exterior, at an American university.

My ballistic institute is having hard sledding. At first encouraged by a vote of the Naval Consulting Board, turned down by the Honorable the Secretary of the Navy (without a word of regret), financed by a great arms company for awhile, helped by the Bache and Rumford Funds, it looks as if it would have to be given up for lack of money. When we began I had one assistant, one machinist and

three students, who all went to work vigorously. Last year I hired several assistants, and when I returned from France I had to put my hand in my pocket. That is I borrowed money at six per cent. This method of high finance may do for high trajectories, but it can not continue forever. I hear much of the National Research Council, but I do not see any money. I am an elderly man, and have experienced three disillusionments connected with the names of great millionaires. "Timeo Danaos et dona ferentes"—I fear organizations even when they offer me money—much more when they don't! Last year I gave a paper at the American Philosophical Society on the work of our ballistic institute, but I have never had the time to have it published.

I did not get to the front in the war—not till last summer. I had no uniform, and few helpers. So I got no glory, but some debts. A propos of Professor Wilson's letter about the University of Strasbourg, I should like to say that I visited it last year, and was shown all over it, and that the French are making it first class. Professor Pierre Weiss is going to have the best facilities in the world for the study of magnetism. I made about two hundred and fifty lantern slides of the places visited by our mission, and have been giving lectures on it ever since. Strasbourg figures largely in them.

ARTHUR GORDON WEBSTER

SCIENTIFIC BOOKS

KNOWLTON'S CATALOGUE OF FOSSIL PLANTS[1]

IN 1898 Dr. Knowlton published "A Catalogue of the Cretaceous and Tertiary Plants of North America." We now have from the same pen a work with the very similar title of "A Catalogue of the Mesozoic and Cenozoic Plants of North America." This is a far more comprehensive work than the former, or than its title indicates. To say that it about doubles the number of known species is but a slight indication of the way in which it mirrors the progress that paleobotany has made in America in the past twenty years, for while very many significant new forms are added, many others that existed in name only have disappeared from the literature. Botanical determinations in many cases have been placed on a firmer footing during the interval and geological occurrences are now given with much greater precision, in fact, in so far as the progress of stratigraphic and areal geology is concerned with plant-bearing units, the present work may be said to show the progress made in stratigraphy during the past two decades.

Only those who know the drudgery of such compilations can appreciate the vast labor that has gone into the making of this book. The author has been one of the most influential factors in the progress of paleobotany in this country during the present generation and that he should have found the time to place this epitome of its present status before the public is a cause for sincere congratulation, not alone to him but to all who may have occasion to refer to the work. Fellow geologists will probably not need to have its merits or usefulness called to their attention, but botanists are not so likely to scan the lists of publications of the U. S. Geological Survey.

There is a stratigraphic table, a bibliography, followed by the body of the catalogue arranged alphabetically. In this part references are given to the original description of each genus, type species are indicated and under each species the synonymy, principal citations and geological and geographical distribution are given. Following the body of the catalogue, the included genera are given in their biological arrangement. This is followed by floral lists for each of the North American Mesozoic and Cenozoic plant bearing formations—a most useful feature of wide interest.

EDWARD W. BERRY

[1] Bulletin U. S. Geological Survey, No. 696, 815 pp., 1919 (1920).

NOTES ON METEOROLOGY

THE WEST INDIAN HURRICANE OF SEPTEMBER, 1919

This hurricane, which seems to have been the largest that has occurred in the Gulf of Mexico since the U. S. Weather service was

established, has been the subject of much study. A rather full account of the storm and its effects is given in the *Monthly Weather Review* by Dr. H. C. Frankenfield, and others in the regions affected.[6] Appearing in the Bahamas on September 6, the hurricane passed through Florida Straits on the 9th, 10th, was lost in the Gulf of Mexico from the 11th to 13th, went ashore on the south Texas coast on the 14th and broke up in the southern Rockies. A surviving portion may have formed the germ for the cyclone with heavy rains[7] which passed from northern New Mexico to the Great Lakes from the 17th to 19th.

Although people in Key West had ample warning, and did everything possible to protect shipping and buildings, the losses sustained were estimated at $2,000,000. The Weather Bureau official in charge, Mr. H. B. Boyer says:

> Hurricane warnings were immediately displayed [on receipt of telegram from Washington at 1:05 P.M. September 8] and the information disseminated by every available means. The response to this warning was immediate and there followed a period of great activity, especially as regards shipping. Vessels were moved to safer anchorage or better secured, and all weak places in residences and buildings of all descriptions were strengthened as much as possible by nailing and battening doors, windows, roof hatches, etc. In the terrific gusts that prevailed during the height of the storm stanch brick structures had walls blown out and large vessels, firmly secured, were torn from their fastenings or moorings and blown on the banks. . . . Winds of gale force and over lasted continuously from about 7 A.M. on the 9th to about 9:30 P.M. the 10th.

The center of the storm passed about 30 or 40 miles south of Key West. The rainfall was estimated at over 13 inches. The Weather Bureau stationed at Sand Key, several miles nearer the path of the center was all but washed away, the island, and all outstanding and superstructures having been carried away or blown down by waves or winds. As the center passed over the Dry Tortugas the pressure fell to 27.36 inches[8] (as observed on the tank steamer *Fred W. Weller*), and the wind about the center was estimated at 125 mi./hr.

> With one or two unimportant exceptions no reports were received from the Gulf of Mexico after the morning of the 10th until after the storm had passed into Texas, which was during the day of the 14th. It was, therefore, absolutely impossible to forecast the intensity and progress of the storm, and the coast stations far from the center of the storm afforded but meager information. (Forecaster.)

As one newspaper put it, "The Weather Bureau suffered from its own efficiency," by holding vessels in port. Of the 10 vessels reported lost or missing, one with 488 people, and the other 25 reported damaged,[9] none had left port in spite of warnings, which were issued at Florida ports September 8 and other Gulf ports September 10. Later, such few logs as were received from vessels caught in the Gulf by the storm indicate that for a time the hurricane was curving toward the Louisiana coast, as surmised by the forecaster, and that it then renewed its course westward, apparently because of a rise in atmospheric pressure in its path, due to the approach of a high pressure area.

Although strong winds and a flood tide occurred at Galveston, Weather Bureau warnings saved three million bushels of grain and many cattle. The damage at Galveston was estimated at $60,000, and that in the vicinity at about $200,000 more.

At Corpus Christi and vicinity the weather on the 13th, the day before the storm was op-

[6] September, 1919, Vol. 47, pp. 664–673, 639–641, 6 figs., 11 charts.

[7] Very heavy downpours locally on the valley of the Solomon River in Kansas, September 17 and 18, caused a sharp rise in that river to 33.6 feet at Beloit—15 feet above flood-stage on the 20th. *Ibid.*, p. 674.

[8] Some other very low barometer readings in other tropical cyclones have been: 27.06 in., Habana, Cuba, October 11, 1846; 26.85 in., Morne Rouge, Martinique, August 18 or 19, 1891; 24.76 in., Vohemare, Madagascar, February 3, 1899; and 26.16 in., S.S. *Arethusa*, lat. 13° 35′ N., long. 134° 30′ E., December 16, 1900.

[9] *N. Y. Maritime Register*, September and October issues.

pressive in spite of a steady north wind and unusual, close-sticking swarms of flies were bothersome. On the Gulf coast the hurricane tide began to rise about noon on the 13th and the sea became very choppy. During the late afternoon a dark line widening into a band in the eastern sky was to be seen slowly rising. The story of 284 lives lost and $20,000,000 property damage at Corpus Christi and vicinity, as reported soon after the storm does not need to be repeated here. The extremely high tide, "15 feet," covered the low ground and allowed the great waves to demolish 900 houses, and numerous substantial commercial establishments.

A map shows that the heaviest rainfall, September 14–17, in Texas was 12 inches, and in New Mexico, nearly 10 inches. More seems to have fallen in the mountains of northern Mexico, for a great flood rise suddenly on the Rio Grande, at Eagle Pass the rise being 27.2 feet in the 24 hours ending at 7 A.M., the 17th. For about 100 miles above the mouth of the river it is said to have widened to 40 or 50 miles. In connection with the hurricane at least two tornadoes occurred—one at Goulds, Florida, and the other near Hobbs, in southeastern New Mexico.

Mr. R. H. Weightman made a study of the wind conditions over the United States, Central America and the West Indies preceding and during the hurricane, using cloud observations, pilot balloon and kite data for the winds aloft. There was a deep (6 km. or more) circulation of easterly or northeasterly winds throughout the southern states as the center of the cyclone approached and passed several hundred miles to the south.[10]

CHARLES F. BROOKS

WASHINGTON, D. C.

SPECIAL ARTICLES

TECHNIQUE OF OPERATING ON CHICK EMBRYOS

DURING the past five years, a number of workers in the department of anatomy at the University of Missouri have studied problems which involved operations on chick embryos. Since, for many of these studies, it was necessary that the chicks should continue to live and develop to a late stage of embryonic life or to the time of hatching, it was most desirable to develop a satisfactory technique. This has apparently been accomplished and it therefore seems worth while to record these methods briefly for the benefit of other workers in experimental embryology.

Operations are carried out under the binocular microscope, enclosed in a warm box, heated by electric light bulbs. Light is furnished by a desk arc light. A flask containing dilute copper sulphate serves to concentrate, cool, and properly color the light.

The egg is taken from the incubator and candled. By this means the location of the embryo and the extent of the air chamber may be seen and these are marked with pencil on the egg shell. The egg is then placed in a dish containing water, warmed to 38°–40° C., and deep enough so that the air chamber is completely immersed. The egg may be held in place in the water by tucking gauze around it. Mr. E. C. Albritton has devised a simple and ingenious wire frame for this purpose which fits over the edge of the dish, with an inner suspended portion into which the egg fits, the egg being held in the desired position by rubber bands. He also devised a simple steam-heating apparatus for keeping the water warm which obviated the necessity of using a warm box.

The portion of the egg containing the embryo, which is exposed to the air, is swabbed with alcohol and allowed to dry. A small opening is then made in the egg shell by means of a needle or sharp pointed knife. The shell fragments are picked away with forceps, care being taken not to tear the shell membrane beneath. An opening 7 mm. in diameter is sufficiently large for most operations. A drop or two of sterile Ringer's solution is then dropped in the opening, after which the shell membrane may be stripped off with ease.

[10] *Monthly Weather Rev.*, October, 1919, Vol. 47, pp. 717–720, 11 figs.

Simple aseptic precautions are observed for all operations. The forceps, knives, needles, etc., for opening the shell are flamed before using. The more delicate instruments used for the operations proper are simply dipped in alcohol and allowed to dry. The Ringer's solution and other fluids introduced into the shell are boiled for a few minutes and allowed to cool to 38° C.

When the stage of operation is one in which the amnion already surrounds the embryo, the sac may be cut open and, after the desired operation has been performed, it can be "sutured" by pinching the edges together, and will heal rapidly and completely.

Various methods were tried for removing portions of the embryo and the details of these operations can not be given here as they were modified for each particular set of experiments. The electric cautery was tried and abandoned because of the difficulty of localizing the burn when the embryo is surrounded by fluid. The method of cutting and dissecting was the one most frequently employed. For dissecting away somites, spinal cord, etc., steel needles ground down to fine points were used. For removing a more prominent portion, such as the heart, the tail, or a limb bud, iridectomy scissors proved to be the most useful instrument. In removing a blood vessel it was found advisable to inject a small amount of Berlin blue, previously boiled, directly into the vessel. This material clumps on contact with the blood, stopping the circulation and effectively plugging the vessel and at the same time outlining the vessel wall. The vessel can then be dissected away rapidly, without causing hemorrhage.

Mr. E. C. Albritton made use of electrolysis for an extensive series of operations using a needle and a pair of forceps connected by wire to the two poles of a weak dry battery. The needle is placed on the region to be removed, and the forceps a short distance away, in the fluid surrounding the embryo.

After the operation a small window of thin mica is flamed and placed over the opening and sealed down with heated Gerlach's mixture (beeswax 2 parts, lump resin 3 parts). The egg is then returned to the incubator. The egg is turned so as to keep the window at the side or below in order to prevent sticking of the embryo to the jagged edges of the shell. A ring of filter paper placed over the exposed wax prevents its sticking to the floor of the incubator. It is well to rotate the egg slightly several times during the first few hours after its return to the incubator. This may be done automatically by a cradle rocked by an attachment to an ordinary alarm clock. If this is done the yolk remains freely movable and the embryo can be brought around under the window, when desired, for observation.

The method of keeping the air chamber immersed in water at incubator temperature during the operation has only recently been adopted and it has greatly reduced the mortality of chicks operated on at the age of forty-eight hours and over. Formerly, when the shell was opened, without this precaution, the yolk always sagged away from the opening and before the operation could proceed it became necessary to add Ringer's solution, drop by drop, in order to bring the embryo back to the level of the opening. This usually consumed more time than the operation proper. On opening such an egg immediately after the operation it is found that the air chamber has been completely obliterated. Evidently, this sagging away of the yolk from the opening is caused by the gradual forcing out of air from the air chamber. When such an egg with the air chamber obliterated and filled with Ringer's solution is returned to the incubator it forms an inelastic chamber with no room for expansion of the contents. Any slight increase in temperature, in such an egg, would seem to be sufficient, as a result of the increased pressure, to cause embarassment to the heart beat, in embryos in which the circulation has started. Whether this is the correct explanation or not, many chicks died, when this method was used, within a few hours after their return to the incubator.

However, in the embryos in which the air chamber is immersed during the operation, almost no sinking of the yolk takes place

upon opening the shell, and, on candling such eggs after sealing, it is found that the size of the air chamber remains unchanged. With the old method we frequently had a mortality of 50 per cent or higher in the first twenty-four hours. With the new method the deaths during the first twenty-four hours are reduced almost to zero.

Embryos may die three to five days after the operation and for these later deaths we have not yet found the cause or causes.

ELIOT R. CLARK

UNIVERSITY OF MISSOURI

THE AMERICAN CHEMICAL SOCIETY. VIII

The composition of okra seed oil: GEORGE S. JAMIESON AND WALTER F. BAUGHMAN. (By title.) Several lots of the seed of the okra (*Abelmoschus esculentus*) were received at various times from E. A. McIllhenny of Avery Island, Louisiana. The seed were found to contain about 15 per cent. of oil. The oil expressed from the seeds by means of the expeller had a greenish yellow color. The results of the analysis of the four expressed okra seed oils are given in the following table:

Sample No.	1	2	3	4
Iodine No. (Hanus)	93.2	100.3	95.5	95.2
Saponification value	195.5	195.6	195.6	195.2
Polenske No.				0.23
Reichert Meissl No.				0.26
Acetyl value	23.9	16.2	11.5	21.4
Acid value		0.66	0.34	1.42
Specific gravity at 25° C.	0.9187	0.9182	0.9160	0.9172
Refractive index at 25° C.	1.4692	1.4693	1.4695	1.4702
Unsaponifiable matter, per cent.				0.37
Soluble acids		0.12	0.09	0.14
Insoluble acids, per cent.		95.90	96.27	96.20
Unsaturated acids, per cent.				67.33
Saturated acids, per cent.				29.22
Titer insoluble acids				38.5° C.

From the data obtained by a separation of the various fatty acids the percentages of the acid glycerides in the oil were calculated. The composition of the okra seed oil was found to be as follows:

		Per Cent.
Glycerides of	Palmitic acid	27.23
	Stearic acid	2.75
	Arachidic acid	0.05
	Oleic acid	43.74
	Linolic acid	26.62
	Unsaponifiable matter.	.37

The composition of the oil from the seed of the Hubbard squash: WALTER F. BAUGHMAN AND GEORGE S. JAMIESON. (By title.) The oil for this investigation was expressed from the seed of the Hubbard squash (*Curcurbita maxima*) by means of the expeller. A portion of the oil was refined by the well-known alkali process and bleached with fuller's earth. The crude oil had a brownish red color and the refined portion had a yellow color. Both crude and refined oils had a bland fatty taste. The following are the chemical and physical characteristics:

Specific gravity at 25°	.9179
Refractive index at 25°	1.4714
Iodine number (Hanus)	121.0
Saponification value	191.5
Reichert Meissl no.	0.37
Polenske no	0.39
Acetyl value	27.8
Acid value	0.5
Unsaponifiable matter	1.06
Soluble acids %	0.33
Insoluble acids %	94.66
(Solid) saturated acids %	18.37
(Liquid) unsaturated acids %	76.45
Titer (insoluble acids)	29.8° C.

The composition of Hubbard squash seed oil was found to be as follows:

		Per Cent.
Glycerides of	Palmitic acid	12.73
	Stearic acid	6.12
	Arachidic acid	0.04
	Oleic acid	36.58
	Linolic acid	43.34
	Unsaponifiable matter.	1.06

Notes on the composition of the sorghum plant: J. J. WILLAMAN, R. M. WEST, D. O. SPRIESTERSBACH AND G. E. HOLM. (By title.) The juice of sorghum cane contains a high percentage of non-

protein nitrogen compounds which give much trouble in the defecation of the juice for sirup. l-leucin, d-l-asparagin, glutamin and aspartic acid have been identified. The acids found in the juice are aconitic, citric, oxalic, tartaric and malic. The hexoses decrease, and sucrose increases, as maturity approaches. In northern-grown cane the sucrose-hexose ratio is considerably lower than in southern-grown cane, and the total sugars are also much less. During the pre-maturation period the sorghum plant lays down a protein-cellulose framework, which is filled in with carbohydrate during the final maturation period. This carbohydrate is starch in the case of the seed head, and sucrose in the stalk. The removal of the seed heads prior to maturity hastens the production of sucrose in the stalk, but does not affect the total amount formed.

The physiology of germinating Juniperus seeds: D. A. Pack. (By title.) The *Juniperus* seed fails to germinate when put under ordinary germinating conditions. The changes, that prepare this seed for germination, are brought about by storing at 5° C. These changes are characterized as follows: an early and complete imbibition of water; a slow increase of the H^+ concentration and total acid; evident changes in the stored food material; very slight increase of the respiration and oxidase activity; slow enlargement of the embryo with the development of internal stress; steady decrease in the viscosity of the seed coat; marked increase in catalase activity; and an increase in the vitality of the seed. A good percentage of germination follows at once upon the completion of these changes.

The biochemist on the hospital staff: Frederick S. Hammett. The paper pointed out the advantage which would accrue to medicine if the hospital biochemist were regarded as a coordinate member of the hospital staff, a specialist in a special field, rather than as a mere technician who makes routine analyses.

A spectrographic study of certain biochemical color reactions: G. L. Wendt and T. Tadokoro. (By title.)

Studies of wheat flour grades. I. Electrical conductivity of water extracts: C. H. Bailey and F. A. Collatz. (By title.) The studies previously reported by one of us (Science, Vol. 47, pp. 645–647) were continued, and it was found that time and temperature of extraction affected the electrical conductivity of water extracts of wheat flour. The conductivity increased with the period of extraction, the proportional increase being greater when the extraction was conducted at lower temperatures, and also with the lower grades of flour. The relative conductivity increased as the temperature of extraction was raised above 0° until 60° was approached, when it began to diminish. A standard procedure was adopted for comparing a number of flours containing from 0.40 per cent. to 2.38 per cent. of ash. The flour: water (1: 10) mixture was held at 25° for exactly 30 minutes, centrifuged, and the conductivity of the clear liquid determined by means of a dipping electrode constructed for the purpose. When examined in this manner a remarkably close parallelism was observed between the conductivity and the ash content.

Studies of wheat flour grades. II. Buffer values of water extracts: C. H. Bailey and Anna Peterson. (By title.) The hydrogen-ion concentration of water extracts of various grades of wheat flour varies between rather narrow limits. Flours with an ash content of 0.45 per cent. yielded an extract (prepared by extracting a 1: 5 mixture for 60 minutes at 25°) of Ph = 6.1, while the extracts of flours containing from 1.2 per cent. to 1.6 per cent. of ash had a Ph = about 6.4. The buffer values of the extracts of these flours varied greatly, however. Thus the addition of 10 c.c. of N/50 NaOH increased the Ph of patent flour extracts 3.3 (*i. e.*, to about 9.4) while the extract of lower grades was increased in some instances only 0.6 to .9 in terms of Ph. The increase in Ph is thus inversely proportional to the ash content, and the ratios are quite exact. The buffer value of extracts uniformly prepared is indicative of the grade of sound flours milled from normal wheat.

The preparation of certain monocarboxylic acids from sugars: I. K. Phelps and W. T. McGeorge.

Charles L. Parsons,
Secretary

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science

Published every Friday by

THE SCIENCE PRESS

LANCASTER, PA. GARRISON, N. Y.

NEW YORK, N. Y.

Entered in the post-office at Lancaster, Pa., as second class matter